under the following heads: (1) Asymmetry of the normal Fibonacci series, (2) Symmetrical construction, in which the Fibonacci ratios are lost, (3) The special case of "least concentrated" asymmetry, (4) Non-concentrated symmetry, (5) Multijugate systems, and (6) Anomalous systems. Subsequent sections will include the consideration of secondary disturbances in the primary system, the relations of dorsiventral primordia, deductions from the mathematical investigations of the log. spiral systems, and the relation of all these factors to the interpretation of floral structures in the form of floral diagrams.—J. M C.

NOTES FOR STUDENTS.

L. GUIGNARD[17] has discovered "double fertilization" to be a common phenomenon among the Ranunculaceae. To the species he had previously announced in 1900 (*Caltha palustris*, *Ranunculus Flammula*, *Helleborus foetidus*, *Anemone nemorosa*, *Clematis Viticella*, and *Nigella sativa*) he now adds *Nigella Damascena* and *Ranunculus Cymbalaria*. Nawaschin published double fertilization in *Delphinium elatum* two years ago. Double fertilization, therefore, may be regarded as a general habit among Ranunculaceae.—J. M. C.

DAVID GRIFFITHS[18] has described the self-burial of the seeds of *Plantago fastigiata* in the desert region of southern Arizona. His conclusion is that the function of the mucilage is the burial of the seed, and that it is accomplished by the tension set up owing to the contraction of the expanded mucilage which has become firmly attached around its outer and lower edges to the particles of soil into which it has penetrated, resulting in a compacting of the soil immediately below the seed and its coat so as to form a pit into which the seed is forced. The cup-shaped depression is subsequently filled with earth by entirely external influences.—J. M. C.

IN A RECENT CONTRIBUTION[19] from the Gray Herbarium, M. L. Fernald presents the northeastern Carices of the section Hyparrhenae, reaching conclusions very different from those generally accepted by American caricologists. After discussing in considerable detail the more important questions, he presents a synopsis of the forty-one recognized species, including descriptions of four new species and ten new varieties. In the second part of the contribution the variations of some boreal carices are discussed, the species being *C. aquatilis*, *C. pilulifera*, *C. communis*, *C. pennsylvanica*, *C. umbellata*, *C. vaginata*, *C. saltuensis*, and *C. capillaris*.—J. M. C.

[17] Double fécondation chez les Renonculácees. Jour. Botanique **15**: 394-408. *figs. 1-16.* 1901.

[18] A novel seed planter. Bull. Torr. Bot. Club **29**: 164-169. 1902.

[19] FERNALD, M. L., Contributions from the Gray Herbarium of Harvard University. New Series, no. 22. Proc. Amer. Acad. **37**: 447-514. *pls. 1-5.* 1902.

RECENTLY Zimmermann[20] has described some remarkable bacterial nodules which occur in leaves of various Rubiaceae (*Punetta lanceolata, P. angustifolia, P. indica*, and *Grumilea micrantha*). These nodules consist of masses of spongy parenchyma, the intercellular spaces of which are filled with bacteria. No mention is made whether the bacteria in any way affect the cell walls. The author supposes that the bacteria get into the leaves through a stomate which he finds immediately above each nodule on the upper leaf surface. He made no determination as to a possible causal relation between the nodules and the bacteria, reserving this for further study.— H. V. SCHRENK.

F. W. OLIVER[21] has described a sporangium of one of the paleozoic ferns, in which an interrupted ring of tracheal elements occurs between the wall and the sporogenous tissue, in the position of a tapetum. The tracheae are rather thin-walled and exhibit well-marked pits of the reticulate type. He is inclined to refer the sporangium to the Botryopterideae, and since these ferns hold certain anatomical relations to the Cycadofilices, this vascular sporangium becomes suggestive of the possible character of the unknown sporangia in the latter group. Of course the occurrence of tracheal elements in the megasporangia of gymnosperms and certain angiosperms is well known.— J. M. C.

A. C. SEWARD and ELIZABETH DALE[22] have described the four species of Dipteris, a genus of eastern Asiatic and East Indian ferns, giving full synonymy ; have presented in detail the anatomical structure of *D. conjugata ;* in discussing the affinities of the genus as indicated by anatomical characters, and combining these characters with those presented by the sporangium and the form and venation of the fronds, have reached the opinion that Dipteris should be removed from the Polypodiaceae and included in a separate family, of which it represents the solitary surviving type ; and have traced the geological history of the genus, which supports the statement that the species of Dipteris are remnants of a family with a wide European distribution during the earlier part of the Mesozoic.—J. M. C.

IN STUDYING THE EMBRYO of Nymphaea, Henry S. Conard[23] has had occasion to compare it with that of Nelumbo as recently described by H. L. Lyon and noted in this journal (**33** : 165. 1902.) There is in both the same "spherical embryo" consisting of hundreds of cells, but in Nymphaea there is also a suspensor of three to five cells in linear series. In Nymphaea the

[20] ZIMMERMANN, A., Über Bacterienknoten in den Blättern einiger Rubiaceae. Jahrb. Wiss. Bot. **37** : 1. *figs. 9.* 1901.

[21] On a vascular sporangium from the Stephanian of Grand 'Croix. The New Phytologist **1** : 60–67. *pl. 1.* 1902.

[22] On the structure and affinities of Dipteris, with notes on the geological history of the Dipteridinae. Phil. Trans. Roy. Soc. London **194** : 487-513. *pls. 47-49.* 1901.

[23] Note on the embryo of Nymphaea. Science **15** : 316. 1902.

spherical mass of cells gives rise to two opposite and distinct cotyledons, with the plumule between them. Later the cotyledons become hemispherical and concave, applied against each other all round by the edges, and enclosing a central cavity occupied by the plumule. This seems to indicate that the embryo of Nelumbo must be regarded as dicotyledonous and unsymmetrical, rather than monocotyledonous with a two-lobed cotyledon.—J. M. C.

GEORGE H. SHULL[24] has made a quantitative study of variation in the bracts, rays, and disk florets of certain species of Aster. His conclusions are that there is a close correlation between bracts and rays, arising from the fact that the rays are axillary to the bracts; that the degree of imbrication of the bracts bears a relation to the number of empty bracts; that in a single group of specimens of *A. prenanthoides* the number of bracts, rays, and disk florets decreases continuously from the beginning to the end of the flowering season; and that the character of the curves and the position of their means and modes likewise change continuously. Curves and constants were determined for the material studied; and constants determined for several individuals of *A. punicus*, growing in identical surroundings, indicated how great variations may exist in the variability constants of individuals.—J. M. C.

IN HIS THIRD PAPER[25] on American ferns, Professor Underwood discusses the order of their relative importance, are (1) type of venation, (2) habit and growth characters of stem, (3) position of sori in relation to veins, and (4) indusial characters. His history of the migration and shifting of generic names and limits reveals a tangled mass of nomenclature, and proves the necessity of some agreement for anchoring generic names. The fifteen American genera of Aspidieae, only three of which are represented in the Northern States, are recognized as follows: *Leptogramma* J. Sm., *Phegopteris* Fée, *Plecosorus* Fée, *Polystichum* Roth., *Cyclopeltis* J. Sm., *Didymochlaena* Desv., *Camptodium* Fée, *Dryopteris* Adans., *Phanerophlebia* Presl, *Goniopteris* Presl, *Meniscium* Schreb., *Cyclosorus* Link, *Fadyenia* Hook. & Baur, *Tectaria* Cav., and *Sagenia* Presl.—J. M. C.

ANOTHER PAPER proving that the pollen mother cell of Asclepias gives rise to four microspores has just appeared.[26] Strasburger[27] and Frye,[28] whose

[24] A quantitative study of variation in the bracts, rays, and disk florets of *Aster Shortii*, *A. Novae-Angliae*, *A. puniceus*, and *A. prenanthoides*, from Yellow Springs, Ohio. Amer. Nat. **36**: 111–152. 1902.

[25] Bull. Tor. Bot. Club **29**: 121–136. 1902.

the genera of Aspidieae. The several characters he takes into account, in

[26] GAGER, C. S., The development of the pollinium and sperm cells in *Asclepias Cornuti*. Annals of Botany **16**: 123–148. *pl.* 7. 1902.

[27] STRASBURGER, E., Einige Bemerkungen zu Pollenbildung bei Asclepias. Ber. Deutsch. Bot. Gesells. **19**: 450–454. 1901.

[28] FRYE, T. C., Development of the pollen in some Asclepiadaceae. BOT. GAZ. **32**: 325–330. *pl.* 13. 1901.

work was done independently and whose results were published almost simultaneously about six months ago, made it plain that the mother cell gives rise to a row of four microspores. Both writers based their conclusions upon a cytological study of the mother cell, and the mitoses which occur as the mother cell gives rise to the four spores. Mr. Gager traverses about the same ground and arrives at the same conclusions. Four years ago W. C. Stevens[29] made the statement that "in *Asclepias Cornuti* the pollen mother cell divides twice, producing a radial row of four pollen grains." The statement is made as if the writer were referring to an accepted fact, and not as if he were making a contribution. Being referred to in this incidental way, in a paper devoted to a study of the kinoplasm and nucleolus, this unconscious contribution might possibly have been overlooked even if it had appeared in a journal of wide circulation; but appearing as it did in a university quarterly, it was as thoroughly buried as if it had been published in an agricultural bulletin. Real contributions to morphology or cytology are so infrequent in such publications that they are almost sure to be lost unless the investigator happens to recall them on account of personal copies among his separates. Any one of the four papers is sufficient to prove conclusively that in Asclepias the pollen mother cell gives rise to four pollen grains, instead of being transformed directly into a single pollen grain, as was formerly supposed.—CHARLES J. CHAMBERLAIN.

ITEMS OF TAXONOMIC INTEREST are as follows: B. L. ROBINSON (Rhodora **4**: 65–73. *pl. 35.* 1902), in presenting the New England species of Polygonum of the section Avicularia, has described a new species (*P. Fowleri*).—ARTHUR BENNETT (Jour. Bot. **40**: 145–149. 1902), in continuing his "Notes on Potamogeton," describes two new species (*P. rectifolius* and *P. strictifolius*) from the United States.—E. L. GREENE (Ottawa Nat. **16**: 32–34. 1902) has published five new species of Ranunculus from various regions of the United States and Canada.—N. L. BRITTON (Torreya **29**: 43. 1902) has described a new Peperomia from the Island of St. Kitts, British West Indies.—TAUBERT (Bull. Acad. Roy. Sci. Danemark. pp. 175–179. *pls. 3–4.* 1901) has described two new Brazilian genera (*Glaziocharis* and *Triscyphus*) of Burmanniaceae from the collections of Dr. A. Glaziou.—PH. VAN TIEGHEM (Jour. Botanique **15**: 389–394. 1901) has described a new Brazilian genus (*Epiblepharis*) which belongs with Luxembourgia in the family (Luxembourgiaceae) he has set apart from Ochnaceae. He has also described (*idem* **16**: 33–47. 1902) three additional new genera (*Setouratea, Campylospermum,* and *Bisetaria*) of Ochnaceae. —P. A. RYDBERG (Bull. Torr. Bot. Club **29**: 145–160. 1902), in his seventh paper entitled "Studies on the Rocky mountain flora," describes new species

[29] STEVENS, W. C., The behavior of the kinoplasm and nucleolus in the division of the pollen mother cells of *Asclepias Cornuti.* Kansas Univ. Quarterly **7**: 77–85. *pl. 15.* 1898.

of Aquilegia (4), Delphinium (5), Aconitum (4), Anemone (3), Clematis (2), Atragene (3), Ranunculus (4), Papaver, Argemone and Bicuculla.— G. E. OSTERHOUT (*idem* 173–174) has described a new species of Hesperaster from Colorado.—ELSIE M. KUPFER (*idem* 137–144. *pl. 8*), in studies of certain genera of Pezizineae, reestablishes Urnula, determines the relationship between Geopyxis and Urnula, and establishes the new genus *Chorioactis* (Pezizaceae). —J. M. C.

WILLIAM H. LANG[30] has been able to secure in Ceylon abundant prothallia of *Ophioglossum pendulum* and *Helminothostachys zeylanica* for study. The subterranean, tuberous, saprophytic character of the gametophyte of Ophioglossaceae is well known, and in the main these studies bear out those of Campbell and Jeffrey on Botrychium. In Ophioglossum the prothallium is usually branched, the short branches radiating in all directions; while in Helminthostachys there is a lobed basal portion from which arises a cylindrical process bearing the sex organs. In both an endophytic fungus is present. The antheridia and archegonia, so far as their development and structure were determined, present no new features. The author discusses the problematical relationships of the Ophioglossaceae, from the standpoint of the gametophyte, including its anatomy. He is inclined to believe that there are no constant characters of morphological value that indicate affinity between Ophioglossaceae and the Lycopodiales. On the other hand, the form of the prothallium, the structure of the sexual organs, and the embryogeny of the Ophioglossaceae are to the author such as might be expected in saprophytic forms derived from prothallia of the general type found among Filicales.

In this same connection reference should be made to the alga-like prothallium of *Schizaea bifida*, an Australian fern described by A. P. W. Thomas.[31] A similar prothallium has been described by Mrs. Britton and Miss Taylor for *S. pusilla*, as noted in this journal (**31**: 363. 1901). The prostrate filaments give rise to erect ones that branch profusely, rising to a height of 3–4^{mm}. These prothallia differ from the well-known filamentous ones of Trichomanes in that they are completely filamentous throughout, the venter of the archegonium being entirely free, and even narrowed at the base, remarkably resembling the archegonia of bryophytes in this regard. — J. M. C.

THE QUESTION OF ABSORPTION AND EXCRETION of water and solutes by foliage leaves has been made the subject of a long and varied series of

[30] On the prothalli of *Ophioglossum pendulum* and *Helminthostachys zeylanica*. Annals of Botany **16**: 23–56. *pls. 1–3*. 1902.

[31] An alga-like fern prothallium. Annals of Botany **16**: 165–170. 1902.

experiments by Dandeno.[32] His most important conclusions are as follows:

1. Wilted leaves absorb water when their surface is wet with this substance.

2. Solutes are absorbed in the same way. Certain plants (*e.g.*, Thunbergia, Justicia) may be so arranged as to take up in this manner all the solutes necessary for growth. In the case of Justicia, plants whose leaves were supplied with solutes for seventeen days contained at the end of that time ash to the amount of 17.89 per cent. of their dry weight; similar plants not so supplied contained only 16.37 per cent. of ash.

3. Solutes diffuse outward from leaf tissues when the surface of the leaves is wet with water. These may be resorbed as stated under 2. Guttation drops (tomato, Impatiens, Phaseolus, etc.) and dew drops upon leaves contain salts, mainly $CaCO_3$. When evaporation is too rapid for complete resorption to take place, incrustation results. Distilled water left in contact with living leaves usually becomes alkaline.

4. Solutions applied to the cut end of the petiole of a detached leaf are absorbed and transmitted throughout the leaf. If they have a bad effect upon the leaf, this may be in one of two ways: (*a*) osmotically they may extract water from the leaf cells, thus causing plasmolysis and evident translucence of the affected parts through the presence of water in the intercellular spaces; (*b*) they may affect the cells in a chemical way, in which case no translucence is produced. Ascent in the veins takes place at a rate proportional to the length of the veins; the outline of the affected portion of the leaf is at any time similar to that of the whole leaf.

5. Cut twigs of Salix in early spring show more rapid and better development of the buds when supplied with distilled water than when supplied with a nutrient medium. It is immaterial where this water is absorbed, whether through young leaves, through the cut ends of the twig, or through roots which have grown out. Water cannot be absorbed through the bark.

The experiments are not well summarized, and theoretical suggestions are jumbled with demonstrated facts, so that the paper is difficult to read. The methods by which the experimentation was conducted are quite fully described, and for the points enumerated above they appear sufficient. But several other series of experiments are so unsatisfactory that it seems as though they might have been omitted with an increased clearness of the article as a whole. A rather copious literature is cited, but poorly cited, titles and references being incompletely given.—BURTON E. LIVINGSTON.

[32] DANDENO, J. B., An investigation into the effects of water and aqueous solutions of some of the common inorganic substances on foliage leaves. Transactions of the Canadian Institute **7**: 238–350. 1901.

IN HIS PAPER on causes governing the direction of branch growth Baranetsky[33] presents some new results of experimentation in this field. The author used entire plants, a number of woody and several herbaceous species being brought into requisition. The stems and branches were first bent into various positions and held thus until a geotropic growth curve had resulted, after which the plants were freed and placed upon a revolving klinostat. One of the most important results of the study of these rotating plants is the discovery of what is termed "opposite bending." By this the author means that phenomenon wherein the plant not only straightens a previously formed geotropic curve, but passes the original vertical position and bends in the opposite direction. After the first opposition curve is formed, a return to the original curvature may result, giving a pendulum-like motion of the tip, which exhibits several vibrations of gradually decreasing amplitude, until at length the normal position is reached. Such curving is ascribed to an accelerated growth on the concave side, of sufficient vigor to throw the tip beyond its first position. This then stimulates growth on the new concave side, but with lessened intensity, thus producing the vibration just noted. In his explanation of this opposition curve Baranetsky differs from Vöchting and Czapek, who hold that the increased growth on the concave side is merely sufficient to return the tip to its original position. Baranetsky also suggests that growth on the concave side may be aided by an inhibition on the convex side due to stretching of the cells.

Baranetsky carried on observations in the field as well as by laboratory experiments. The forms studied are divided according to their behavior into three types: the Prunus type includes Aesculus and Euonymus; the linden type includes Ulmus, Fagus, Crataegus, Celtis, and Corylus; and the needle-leaf type includes the pines. The first group is characterized by the upward turning of the side buds, the second by their downward turning, and the third by the wavy branches and sharply turned up tips. For the first type the author states the four following points: (1) physiological bilaterality is absent; (2) lateral shoots behave as main shoots; (3) all shoots are negatively geotropic; and (4) each curve produces an opposition curve which may either lessen or overcome the geotropic curvature. For the second and third types he finds (1) that weight plays an important part in directing the position of branches; (2) that geotropism is very powerful, often forcing the tips to a vertical position even in nature; (3) that epinasty is so slight that it cannot overcome or greatly lessen the geotropic curve.

In general, the author finds that the response to geotropism varies greatly in different species even within the same genus. Nowhere was it found that a weight stimulus caused growth.— P. G. WRIGHTSON.

[33] BARANETSKY, J., Ueber die Ursachen, welche die Richtung der Aeste der Baum- und Straucharten bedingen. Flora 89: 138–239. 1901.

Dr. H. J. Webber in an interesting paper[34] gives the results of his further studies of *Zamia*. The two Florida species, *Z. floridana* DC. and *Z. pumila* L., were formerly incorrectly referred to *Z. integrifolia* Jacq.

It is an interesting fact that development proceeds normally for several days after the strobili have been removed from the plants, so that even living spermatozoids may be secured from such material. The movements of the spermatozoids were studied in a sugar solution.

Although the germination of the microspores was not studied in detail, it is probable that there is an evanescent prothallial cell in addition to the persistent prothallial cell and antheridial cell (second prothallial cell of the author) which are conspicuous in the mature pollen grain. After the division of the antheridial cell to form the stalk and body cells, the persistent prothallial cell and the stalk cell become filled with starch and the former arches into the latter so that there is often the appearance of one cell entirely surrounding the other. The blepharoplasts first appear in the body cell (central cell) and are formed *de novo* from the cytoplasm. They are at first very small, being scarcely more than points where a few radiating filaments converge, but as they increase in size, a surrounding membrane and vacuolated contents can be seen. Shortly before the division of the body cell, the nucleus passes through a synapsis stage which is regarded as normal and not at all due to reagents. The spindle is developed while the nuclear membrane is still intact. It is apparently entirely of nuclear origin and none of the fibers have any connection with the blepharoplasts. During the equatorial plate stage, the blepharoplasts break up and in an early anaphase the contents have entirely disappeared, while the outer membrane soon breaks up into numerous granules, which during the formation of the cell plate begin to fuse, thus forming the cilia-bearing band. At first, the band is located in the cytoplasm midway between the nucleus and the periphery of the cell, but it ultimately moves out and becomes appressed to the plasma membrane, where it forms a helicoid spiral of from five to six turns. The entire spermatid is metamorphosed into a spermatozoid, there being no differentiation of a spermatozoid within a mother cell. The mature spermatozoids are the largest known in any plant or animal, being visible to the naked eye. They move mainly by means of cilia, but there is also an amoeboid movement of the spiral end.

In fertilization the entire spermatozoid enters the egg, but the nucleus soon slips out from the cytoplasmic sheath, leaving the ciliiferous band in the upper part of the egg. The nucleus moves on and fuses with the egg nucleus. There is a fusion of cytoplasm with cytoplasm and nucleus with nucleus.

[34] Webber, H. J.: Spermatogenesis and fecundation of Zamia. U. S. Dept. of Agriculture, Bureau of Plant Industry. Bull. no. 2. pp. 1–100. *pls. 1–7.* 1901.

Webber still believes that the blepharoplast is not the homologue of the centrosphere or centrosome because it differs from the centrosome "(1) in not forming the center of an aster at the pole of the spindle, being located entirely outside of the spindle in Zamia, Cycas, and Gingko; (2) in having no connection with spindle formation; (3) in being limited to the division of a single cell, thus to one cell generation, no similar organ appearing in any other stage of the plant's development, so far as known; and (4) in having a function differing from that of any typical centrosome, so far as known in plants."—CHARLES J. CHAMBERLAIN.

THE TRANSMUTATION THEORY of Darwin does not, according to Korschinsky,[35] explain how variations come about nor the origin of new forms. As a study of the wild forms alone could not solve the problem, he turned to the cultivated plants for a solution, and asserts for the latter that "no breeder has ever operated with individual variations for the production of new races, and that there has never been observed a heaping up of such variations. On the other hand, all new varieties (with the exception of crosses) whose origin is known developed as sudden variations of true species or hybrid forms." May not these sudden variations play the same rôle in nature, and may not this be an explanation of the discrepancies between the nature and occurrence of variations and the Darwinian theory?

The existence of sudden variations was well known to Darwin, but he laid little stress on these, holding them to be abnormal and exceptional. This sudden appearance Korschinsky calls "heterogenesis," and hopes to show that it is "though a rare yet completely normal phenomenon among plants and animals, and plays in their development an extraordinarily important rôle." The characteristics of heterogenesis is the topic of this paper, to be followed by another in which its rôle in the origin of species is to be treated.

The history of the term "heterogenesis" is traced to Kölliker and his explanation given, whereupon many cases of sudden variations are brought up and discussed. The sources are mainly French. He sums up to show that there appears suddenly a new race as fixed and as constant as those existing from immemorial time. Some persons have explained these as cases of atavism, others as monstrosities; but Korschinsky believes that "heterogenesis often makes it possible for atavism to show itself," and again that "the manifestation called heterogenesis shows itself in the unexpected appearance of different variations from the typical structure. Functional disarrangement of organs is an accompaniment of some, and these are monstrosities; other variations, however, do not disturb the vital functions of

[35] KORSCHINSKY, S., Heterogenesis und Evolution. Ein Beitrag zur Theorie der Entstehung der Arten. Translated from the Russian by S. Tschulok of Zürich. Flora **89**: 240–363. 1901.

the organism and give rise to particular races." Considering all morphological peculiarities and physiological qualities as the results of heterogenesis, we must acknowledge that they do not differ in general from other types or races existing from time immemorial, and which latter, based on the Darwinian theory, we ascribe with confidence as having developed by means of a slow heaping up of characteristics and continuous selection. As, however, we know nothing of the way by which the forms of all wild and the greater proportion of cultivated plants have come about, there comes the question: Is the event of the development of new forms by way of heterogenesis so seldom and exceptional? Does it not occur oftener than we think, and does it not play a certain rôle in the evolution of forms in the plant kingdom? He takes up variability in garden plants under the most prominent forms, and discusses the many observations that have accumulated. Some of his main topics are variations of growth, variations of stem, of crowns, form of leaves, color of leaves, color of flowers, in structure of flowers, variations in blooming, and in fruits. On the basis of this study the peculiarities of heterogenetic characteristics are to be found in the more or less prominent variations readily distinguished from the combinations of unimportant variations which make up an individual in a group of its kind; that is, in the absence of hybridity or heterogenesis, there will be no characteristics radically distinguishing one individual from another.

The direction of variability and the characteristics of heterogenetic variation bring out an interesting discussion of sports. It is characteristic of heterogenetic variations that they are constant, not only by vegetative reproduction, but also when propagated from seed, although, especially in the first generations, some aberrant forms may appear.

Inheritance and variability, whatever their real causes, may be thought of as two forces hidden in the organism, as two antagonistic tendencies. Under normal conditions, we have the identity of succeeding generations, but the tendency to vary is not constant. "It (the tendency to vary) must, so to say, gather the necessary energy during many generations in order finally to overcome the power of inheritance and to give rise to a heterogenetic race." The mechanism resulting in this appearance must be sought in the changes taking place in the sexual products, that is, either in the pollen or in the ovule. It seems probable that the variations are initiated during or after fertilization. The cause of this change, and why one ovule and not another is influenced, remains completely inexplicable.

The list of references at the close covers five and one-half pages.—G. N. Lauman.